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Application No. 10/753,138

Reply to Office Action

*REMARKS/ARGUMENTS**The Pending Claims*

The pending claims are directed to a method of chemically-mechanically polishing a substrate. Claims 1-3, 6-10, 13-19, 21, and 32-43 are currently pending. Reconsideration of the pending claims is respectfully requested.

Discussion of the Claim Amendments

Claims 1, 36, 38, and 39 have been amended to delete formaldehyde and formic acid from the group of reducing agents recited therein. Claims 1, 36, and 39 have been further amended to delete the limitation that the polishing system does not comprise a component having a standard redox potential that is greater than the standard redox potential of the metal in an oxidized form. Claim 7 has been amended to delete formic acid from the group of reducing agents recited therein. Claims 40-43 have been amended to recite a polishing system to comport with the claims from which they depend. No new matter has been added by way of these amendments.

Summary of the Office Action

The Office Action rejects claims 1-3, 6-9, 13-19, 21, 32-37, 39-41, and 43 as allegedly unpatentable over U.S. Patent 6,139,763 (Ina et al.) (hereinafter "the Ina '763 patent") in view of U.S. Patent Application Publication 2002/0086511 A1 (Hartner et al.) (hereinafter "the Hartner '511 publication"). The Office Action also rejects claims 38 and 42 as allegedly unpatentable over U.S. Patent Application Publication 2002/0090820 A1 (Sun et al.) (hereinafter "the Sun '820 publication") in view of the Hartner '511 publication and the Ina '763 patent.

Discussion of the Obviousness Rejections

The Office Action asserts that the Ina '763 patent discloses a method of polishing a metal in an oxidized form, which method comprises contacting a portion of the substrate with a polishing pad and a polishing composition comprising abrasive particles and a reducing agent, which may be formaldehyde or formic acid. The Office Action acknowledges that the Ina '763 patent teaches that the metal in an oxidized form is tantalum oxide, but fails to

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disclose that the metal in an oxidized form may be a noble metal. The Office Action relies on the Hartner '511 publication for its disclosure that iridium oxide can be polished using a chemical-mechanical polishing (CMP) step. Although the Hartner '511 publication is completely silent as to the nature of the CMP step, the Office Action asserts that it would have been obvious to one of ordinary skill in the art at the time of invention to employ the method disclosed in the Ina '763 patent to polish iridium oxide.

As is well-settled, in order to establish a *prima facie* case of obviousness with respect to a claim, the combined references must teach or suggest all of the claim limitations.

The Ina '763 patent is generally directed to a polishing composition which is capable of polishing a tantalum-containing compound layer at a high stock removal rate. The Ina '763 patent discloses a polishing composition comprising (a) an abrasive, (b) an oxidizing agent capable of oxidizing tantalum, (c) a reducing agent that is capable of reducing tantalum oxide formed by the oxidizing agent, and (d) water. The Ina '763 patent provides that the reducing agent capable of reducing tantalum oxide formed by the oxidizing agent is selected from the group consisting of formic acid, oxalic acid, or formaldehyde (Ina '763 patent at col. 6, lines 30-32).

However, the Ina '763 patent fails to disclose or suggest (a) the reducing agents recited in the pending claims or (b) the use of a polishing composition to polish or planarize a substrate surface comprising a noble metal in an oxidized form, wherein the noble metal is selected from the group consisting of platinum, iridium, ruthenium, rhodium, palladium, silver, osmium, gold, and combinations thereof, as recited in the pending claims.

In particular, the Ina '763 patent does not disclose or suggest a polishing composition comprising a reducing agent selected from the group consisting of 3-hydroxy-4-pyrones, α -hydroxy- γ -butyrolactones, borane, borohydrides, dialkylamine boranes, hydrogen, hydroquinones, hypophosphorous acid, trihydroxybenzenes, solvated electrons, sulfurous acid, ascorbic acid, a metal or metal ions in an oxidation state having a standard redox potential that is less than the standard redox potential of the metal in an oxidized form, salts thereof, and mixtures thereof, let alone the use of such a polishing composition to polish or planarize a substrate surface comprising a noble metal in an oxidized form, wherein the noble

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metal is selected from the group consisting of platinum, iridium, ruthenium, rhodium, palladium, silver, osmium, gold, and combinations thereof, as recited in the pending claims.

The Hartner '511 publication fails to cure the deficiencies of the Ina '763 patent. The Hartner '511 publication teaches that the method recited therein can comprise a chemical-mechanical planarization step on a substrate comprising iridium oxide, but the Hartner '511 publication is silent as to the details of the chemical-mechanical planarization step.

Thus, the Ina '763 patent and the Hartner '511 publication, taken separately or together, fail to disclose or suggest all of the elements of the invention as defined by claims 1-3, 6-9, 13-19, 21, 32-37, 39-41, and 43. Accordingly, the obviousness rejection of claims 1-3, 6-9, 13-19, 21, 32-37, 39-41, and 43 is improper and should be withdrawn.

The Office Action further asserts that claims 38 and 42 are unpatentable over the Sun '820 publication in view of the Hartner '511 publication and the Ina '763 patent.

The Office Action relies on the Sun '820 publication for its disclosure of a method for chemical-mechanical polishing with a polishing system comprising abrasive particles and/or a polishing pad, a reducing agent, and water, wherein the polishing system does not comprise an oxidizing agent. The Sun '820 publication is generally directed to a polishing system and a polishing method for selective removal of a barrier layer (e.g., tantalum) on a substrate comprising a dielectric layer (e.g., silicon dioxide). The reducing agent can be hydroxylamine, glucose, sulfathionate, potassium iodide, sodium thiosulfate, oxalic acid, or combinations thereof (the Sun '820 publication at paragraph 50). The Office Action asserts that silicon dioxide is an oxidized metal, and therefore asserts that the Sun '820 publication discloses a method of polishing an oxidized metal.

However, the Sun '820 publication does not disclose a polishing composition comprising a reducing agent recited in pending claims 38 and 42 *nor* the use of a polishing composition to polish a substrate comprising a noble metal selected from the group consisting of platinum, iridium, ruthenium, rhodium, palladium, silver, osmium, gold, and combinations thereof, as recited in pending claims 38 and 42.

In an effort to remedy the deficiencies of the Sun '820 publication with respect to the method defined by claims 38 and 42, the Office Action relies on (a) the Ina '763 patent for its

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alleged disclosure that formaldehyde and formic acid are obvious equivalents of the oxalic acid recited as a reducing agent in the Sun '820 publication, and (b) the Hartner '511 publication for its disclosure that a metal in an oxidized form (e.g., iridium oxide) can be subjected to chemical-mechanical planarization.


As discussed above with respect to the other pending claims, however, the Ina '763 patent and the Hartner '511 publication do not teach or suggest (a) the reducing agents recited in the pending claims or (b) the use of a polishing composition to polish or planarize a substrate surface comprising a noble metal in an oxidized form, wherein the noble metal is selected from the group consisting of platinum, iridium, ruthenium, rhodium, palladium, silver, osmium, gold, and combinations thereof, as recited in the pending claims.

Thus, the Sun '802 publication, the Ina '763 patent, and the Hartner '511 publication, whether considered separately or together, fail to teach or suggest each and every limitation recited in claims 38 and 42. Accordingly, the obviousness rejection of claims 38 and 42 is improper and should be withdrawn.

Conclusion

The application is considered in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,



John Kilyk, Jr., Reg. No. 39,763
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza, Suite 4900
180 North Stetson Avenue
Chicago, Illinois 60601-6731
(312) 616-5600 (telephone)
(312) 616-5700 (facsimile)

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